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AUTHOR Hiscox, Michael D.
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ABSTRACT

Educational item banking presents observers with a considerable paradox. The development of test items from scratch is viewed as wasteful, a luxury in times of declining resources. On the other hand, item banking has failed to become a mature technology despite large amounts of money and the efforts of talented professionals. The question of which group is correct is the subject of this paper. A balance sheet presents the advantages and disadvantages of item banking. Cost estimates for developing item bank tests are compared to costs for conventional test development in order to develop guidelines for the cost-effective application of item banks. Particular attention is paid to the role innovative technologies such as microcomputers and videodiscs might play in item banking. The overall objective of this report is to provide a balanced report on the strengths and weaknesses of educational test item banking. (Author/PN)

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A BALANCE SHEET FOR EDUCATIONAL ITEM BANKING

Michael D. Hiscox, Director
Interwest Applied Research--Portland, Oregon

A paper presented at the annual meeting of the National Council on Measurement in Education
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Introduction

The educational test item seems to have a difficult life. Although few things in this world are created, studied, and refined simply to be discarded, many test items fall into disuse after one appearance on a test. For several reasons, most test items have a brief life.

Several researchers have investigated whether the life span of the test item might be improved by providing the item with a permanent home where its care and feeding are assured. This home, the test "item bank," provides a home for test items, an accommodating environment where sufficient attention is given to the test item to ensure its continued usefulness. Test item banks are now home to several hundred thousand educational test items.

But item banking, despite some obvious advantages and the efforts of several hundred investigators, has failed to ensure the survival and proliferation of items. Its true value to the testing community is a matter of some doubt; many who write test items for a living proceed with their work with little or no assistance from item banks. Yet other test developers swear that item banks are essential and have sponsored many millions of dollars of item bank development work based on their opinions.

The question of which group is correct is the subject of this paper. There will be a discussion of the advantages and disadvantages--both real and perceived--of test item banks. The discussion will revolve around what might best be described as a "balance sheet" for educational item banking. In the same way that the shrewd auditor can tell the financial health of a company from its balance sheet, a shrewd measurement specialist should be able to deduce the value of item banking for a specific application by weighing the strengths and weaknesses we will present.

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The Test Item As a Commodity

In writing A Guide to Educational Item Banking (Hiscox and Brzezinski, 1980), the authors struggled to find a way to view the test item as they believed it should be viewed—not as a conceptual entity but as a concrete product. Unlike the products of many mental efforts, the test item has a definite value, a value related to the importance of the information it solicits for us. In fact, while few developers look upon their items as being worth a specific figure such as $3.98 or $125, this view is essential if we are to know whether the effort involved in preserving test items in item banks is worthwhile.

Unfortunately, discussions of the merit of existing item banks with their developers seldom revolve around the amount of money saved by using the bank. Indeed, it became clear that few developers viewed test items as discrete items of specific worth--items which might be put in an item bank to maintain or enhance their value. Developers were much more likely to discuss the item bank in theoretical, or even philosophical, terms. In an effort to stress the concrete nature of the test item, an analogy was created to compare the test item to an obviously concrete product. Elements of the analogy are instructive in our development of a balance sheet for item banking, and are repeated here.

When you go to your local grocery store, you receive with your purchase a valuable and necessary commodity: a paper grocery bag. The grocery bag you receive is a fine product, the result of much careful study and development. In addition, the bag is generally tailored to your needs; you will receive a small bag for a light load, a larger and sturdier bag for heavier duty. In most cases, the bag works admirably, carrying our groceries efficiently and at reasonable cost.

In the majority of cases, the utility of the bag is undiminished by its previous use. In fact, the bag has undergone some preliminary screening—the obviously defective bags are easily noted; the remainder of them are sound bags which can be counted on for future use. However, the question of future use brings up several problems.

What do you do with used grocery bags? The odds are that the bags are thrown away after the first use, since most people reckon it's more trouble to keep them than they're worth. Rarely do people return the bags for reuse. Yet used grocery bags are perfectly serviceable, and it seems a waste to produce a new bag each time one is needed. Part of the problem is that few stores can integrate the returned bags with the new ones, and also that many people might object to receiving a grocery bag already used by someone else.

An occasional grocery store may collect the bags, taking a customer's previously used bag in exchange for a different one. This bag will perhaps be a different size and weight, being selected to meet the customer's immediate need. Obviously, all the used bags given out are reasonably functional; if a bag is found to be defective it will be removed from the pool of bags.

While the reuse of the bags can save someone money, the store must accept some initial work. It must provide the first stock of bags, screen returned bags, inform customers of the bag exchange policy, keep the available supply of bags consistent with demand, and establish procedures to credit customers returning bags to the pool. Store employees must be knowledgeable about the collection and distribution of the shopping bags. The store must establish ways of classifying the bags and of integrating newly received bags with the existing supply. All things considered, the task of collecting grocery bags for reuse is certainly possible, but it is by no means trivial.

Is the effort worth it? Reusing grocery bags seems a sound idea, but establishing and maintaining a functioning system for reusing the grocery bags causes difficulties. Indeed, only a limited number of stores have gone to the trouble. Further, existing collection systems are scattered and little publicized. All in all, we have a good idea—reusing grocery bags—that has serious problems associated with its implementation. Because of those problems, implementation has not been widespread. And because of limited use, the overall impact of the idea has not been great.

This analogy is intended to stress the concrete nature of the test item. As with a grocery bag, some cost is associated both with producing the commodity and attempting to reuse it. Balancing the value of the extant test item against the difficulties of reuse indicates the merit of item banking. But note that such a

weighing can only be conducted when the test item is viewed as a concrete entity with a specific value.

Item Bank Strengths and Weaknesses

Establishing educational item banks is much like reusing grocery bags. Item banking is an appealing idea which, because of difficulties in implementation, has failed to produce the benefits inherent in the concept. The following paragraphs follow the analogy a bit further and help to explain why item banking is not clearly always a worthwhile concept.

1. A grocery bag is a very useful product. So is a good test item. And just as the bag received much careful consideration on the way to its final form, so has the quality test item. When put to an appropriate use, both the bag and the test item are effective products.

2. But both the bag and the test item can be used improperly. The bag can tear if overloaded, and the item can fail to function properly if put to an inappropriate use. We often blame the bag when our groceries fall to the pavement, and many people blame the test item (rather than the test constructor) for shortcomings in educational tests.

3. Yet in spite of potential misuse, the paper grocery bag is still the best available means of transporting groceries, and the test item is still the most efficient method of ascertaining student knowledge and skills.

4. A grocery bag is basically undiminished by use. A test item is even better after use. The expression "better than new" applies very strongly to test items, for a used item is clearly better than an untried item. Just like the grocery bag, each additional use adds a built-in screening function; the user asks, "Based on this recent trial, is it suitable for future use?"

5. Even so, many people throw away their grocery bags, and many people as much as throw away their test items. Since the items were often created for a single use, that's all they receive. Also, since few users have a good way to store and

retrieve the items for future use, they are often discarded.

6. Some individuals store the items on a shelf, and thus have a bit of a supply for their own use and that of their close acquaintances. But like the shelf full of grocery bags, the supply is likely to be small, it may lack the necessary variety, and it may take time to find the right item. Further, it is often an imposition on the suppliers, since they rarely receive anything of value in return.

7. How could the situation be improved? The best collection and distribution point for grocery bags would not be an individual, but rather the grocery store. Perhaps an individual user of test items is not the best collector of test items. A larger organization, with a greater flow of items, would be preferred. Unfortunately, it is not just a matter of assigning the responsibility to some organization--personnel have to be trained and systems for collecting and distributing items have to be established. Deciding to begin an item bank is in fact much easier than effectively disseminating and maintaining its contents. The item bank developer must obtain the initial items, ensure that needed topics are covered, classify incoming items, charge for out-going items, maintain information on the performance of each item, and, in general, keep the quality of the item bank high.

8. Stores that encourage the exchange of grocery bags are not known outside their immediate area. Similarly, the bulk of existing item banks are known only in the immediate vicinity of the developing organization. If you don't have prior contact with an organization housing an item bank, you might never hear about the bank. The number of "local" item collections is several times larger than the number of "national" collections. The local collections--which are frequently very useful to test developers—are rarely well publicized.

The issue reduces to "Should our efforts go toward writing new test items or banking existing items?" An examination of the balance sheet, as derived from our analogy, shows the following:

<u>In favor of item banking</u>

- o Costs of test development may be reduced.
- o Used items are more valuable than new since defective items will be discarded.

Against item banking

- o Test items can be ineffective or worse when inappropriately used. (This is true for test items regardless of the source, but since item banks are often proposed as a way for less sophisticated developers to create tests, this point is often deemed a disadvantage of item banks.
- o There is a stigma against using items developed for other audiences.
- o Establishing the collection and quality control procedures is difficult.
- o A sound initial collection of items must be available.
- o Knowledgeable people must be available to maintain the item bank.
- o Establishing the worth of items and ensuring their value is difficult.
- o Obtaining a selection of items adequate for all prospective users is difficult
- o There are no established techniques for publicizing the item bank.

While a few other strengths and weaknesses of an item bank will apply in any given situation, the characteristics above seem applicable to anyone considering an item banking effort.

Valuing a Test Item

Even from our preliminary list of strengths and weaknesses, it is clear that the principal advantage of test item banking is the savings of time (and hence money) that results from use of an item bank. Extrapolating from a study by Demaline and Brzezinski (1982), one can expect to see tests developed from item banks to be less expensive than those developed using new items. But that study did not take into account the cost of either establishing or maintaining the item bank. It is difficult to say whether any savings would result had those costs been included.

Unfortunately, the measurement community has little information as to the value of a test item. Certainly, the item used in a classroom test must be considered less valuable than an item from a national norm-referenced test. Likewise, the item written by a novice writer and used without any testing and revision is less valuable than an item which is extensively piloted and revised. Further, an item with

outstanding values for relevant item statistics must be more valuable than one with mediocre values.

It may, in fact, be impossible to determine the precise value of a test item in terms of market value. A highly-regarded national test has a value well in excess of the sum of the costs of developing its items. A classroom test probably has no market value. Since the market value of the item depends on its proposed use and since item bank users would use the items in a variety of situations, we cannot use the market value approach for valuing items.

A better solution is to look only at the costs for users to obtain the items, thus assuming that all costs following creation of the item will be equal whether the item came from a bank or was newly developed. This is not strictly accurate, but is adequate given the precision the calculations will have. Under these circumstances, the cost of obtaining the item from the bank (including the applicable portion of the establishment and maintenance costs) should not exceed the cost of developing the item if an item bank is to be beneficial. Some of the specific costs to consider are:

Costs for Item Bank Item

Portion of costs for developing categorization system
Cost of item review
Payments to content specialists assigning items to categories
Cost of entry into bank storage system
Retrieval costs, including copying and mailing item
Any special formatting work necessary to produce acceptable copy
Any artwork, licensing payments, or other costs associated with item
Cost of obtaining and maintaining item use and statistical data
Cost of panels to select items from the bank

Costs for New Items

Cost of initial content blueprint for items
Creation of objectives and item specifications

Review Panels for objectives and item specifications
Item writers' time
Pilot testing and pilot data analyses
Review of pilot test results by content specialists
Revision of pilot items by item writers
Any artwork, licensing payments, or other costs associated with item

One can hypothesis that the cost of an item bank item may well be less than that of a newly developed item. The costs associated with item development and pilot testing are usually high, and an item bank might therefore offer considerable savings. On the other hand, if the apportioned costs for the item bank item (apportioned costs being those of establishing and maintaining the bank independent of the number of items) are too high because the bank is poorly organized or has an inadequate user base, the cost advantage will be lost.

Every test developer considering the merit of item banking must weigh the cost of the item bank item against that of a newly developed item. It is the cost differential which is important. If the differential favors new development, then item banking has little merit, since there are other significant disadvantages to item banking. If the differential favors the item bank item, a careful weighing of the cost savings versus the disadvantages of item banks will be required.

The Market for Item Banks

Two years after development of the analogy discussed above, a forum sponsored by the Education Commission of the States and Interwest Applied Research was held among a number of measurement experts, most well acquainted with item banking. In general, they validated the strengths and weaknesses cited above. However, they also made some important additions to the list.

The participants stressed that they considered themselves to be qualified item developers and did not feel that very many people could write items better than they and their staffs. They were clearly reluctant to accept items from an unknown source, feeling that the quality of the items might not be adequate. Further, they pointed out, items in an item bank which matched the content covered on their tests

were probably easy to write in the first place. There is little merit in housing "one digit plus one digit addition" items in an item bank, even though most test developers have a need for such items. It is easier to write such an item than retrieve it from the bank. The items which are the most difficult to write—items that deal with synthesis or evaluation skills or with subject matter beyond reading, mathematics and language arts—are least likely to be available in an item bank.

The forum participants raised another important point, one which may best explain the lukewarm reception given educational item banking by the measurement community. They saw little reason to support techniques which reduce the importance of the test development team or make the development of tests much quicker or easier. In common with any managerial group, those responsible for testing programs have staffs and budgets which they do not want to have reduced. There is little incentive to make the development of an educational test a process which can be carried out by relatively unskilled personnel—particularly if they have no evidence that the previous level of quality can be maintained.

While many test development specialists support item banks, they are often professionals whose importance would be enhanced if item banking were widely accepted. This group includes those who know where item collections are located, who have developed statistical procedures to compare tests generated from item banks, who have established part of their professional reputation on item banking, or whose entrepenurial spirit can be satisfied by the development and potential sale of the item banks and associated services. As with many innovations, the advocates are often those who profit from successful implementation of the innovation, not the users themselves. While this is not bad—few clamored for either the automobile or the computer during their developmental stages—few test developers await item banks with the proverbial bated breath.

Opportunities for Item Bank Implementation

Item banks are not a new innovation; the concept has been around for many years. But item banking has not matured sufficiently to be a viable, easy-to-use technology. Item banking still has many "pilot project" and "developmental" overtones that make it less appealing to those measurement specialists with a definite task to

accomplish. Nor has item banking ever generated the enthusiasm of some other measurement innovations such as criterion-referenced testing or latent trait analysis. The reasons for the limited growth of item banking compared to some other innovations are difficult to determine. Perhaps it is because some of the disseminators of item banks have oversold the merit of their collections, leaving a group of users who view item banks as disappointingly mundane. Or perhaps it is because most of the advantages of item banking are practical rather than theoretical. There is ample evidence that innovations which are straightforward and concrete often fail to attract the interest of the "change agents" necessary for their implementation.

Nevertheless, item banking has had two "windows" during which the time was ripe for widescale acceptance. The first was during the competency testing movement of the late 1970s. As governmental and educational agencies throughout the country began to require competency tests; test developers found their work load increased dramatically. Passage of competency testing requirements caused the creation of several thousand new tests. Many of these tests had to be created by local school district personnel who were not experienced test developers and who could have profitted dramatically from easy access to test item banks. Unfortunately, very few usable item banks were available to the developers; most existing item collections were not designed for easy dissemination, while others required adoption of specific test development or reporting procedures which were not necessarily the best ones for any given district. Some organizations which sold items were ill-equipped to handle the numerous orders, causing poor quality tests and service. In short, the competency testing movement offered an excellent opportunity for item banks to secure a place as a valuable educational measurement tool, but they were found wanting.

A second window was, and still is, provided by the widespread adoption of small computers by governmental and educational organizations. Several organizations (e.g., Advanced Learning Technology; Intran; CTB-McGraw Hill; Educational Testing Service; Interwest Applied Research; Macomb County, Michigan School District) have demonstrated computer-based systems that store, retrieve and format test items. Ever since the 1960s, item banking projects have tried to use computers to eliminate many of the time-consuming procedures associated with item banking. With the advent of the microcomputer, the prospects for computerized item banking have never been better.

Unfortunately, many people, including some educational measurement specialists, view the computer not as a tool but as an end in itself. Putting an item bank onto a computer becomes a project goal—never mind whether there is merit in the item bank itself. The popular press has somehow convinced us that the small computer is this friendly little box that we should all grow to understand and love. Perhaps this will someday be a sensible view, but at the moment it is a grave distortion of reality that may lead many a prospective item banker into trouble.

The suitability of any computer for item banking requires a precise analysis of file sizes, response times, anticipated number of users, output speeds and so on. Test item storage and retrieval requires variable length records which are hard to format and search; if one decides to keep information on the item's statistics and its uses, one could easily require 500 or 1000 characters devoted to the item "2+2=." This level of information storage will require one Apple II floppy disk for each 100-200 test items, an unacceptably low storage density. Indeed, some calculations of item bank storage requirements done for the Alaska Department of Education suggest that a rigid disk storing between ten and twenty million characters would be required for a basic skills item bank of realistic size if statistical and use information is to be maintained.

The computers with such storage capabilities are not inordinately expensive, but they are of a level of expense and complexity much higher than most people's perception of the friendly microcomputer. Unfortunately, many people ask the wrong question by inquiring "Can a microcomputer run item bank programming?" The answer is almost always yes, but watching a microcomputer like the Apple II run a poorly constructed item bank program written in BASIC or Pascal is a pitiful sight--the speed is so slow and the storage arrangements so inadequate that retrieving three or four items from a large bank can take as much as ten minutes. The level of microcomputer necessary to produce cost savings for a test development staff is not entirely clear, but it is many levels beyond most people's perceptions.

Item banking elements that are easily dealt with in a manual system sometimes become intolerably complicated with a computer. Consider the simple problem "What is the circumference of this circle?" In a manual system, the item requires drawing a circle and labeling of its radius--a task well within the skills of most test development staffs. In a computerized system, the circle must be put into the

computer through a graphics tablet or graphics program and then stored as digital information. Without extremely elaborate compression techniques, the data required to recreate the circle whenever the item is reviewed or printed is inordinately large; a drawing of any complexity would require storage equivalent to thousands of characters. And even when ways of storing and retrieving the graphics are established, can the printer produce the circle in the right size for the space available and arrange the text appropriately? As an example, what is involved in simply creating and storing the symbol for pi, or a square root sign, or even the division symbol? Unfortunately, much more than most people realize.

The question of formatting tests is a critical one for computerized item bank systems. Math tests require division signs, fractional notations, union and intersection symbols and a host of other elements which are not easy to produce. Reading tests require printing that looks like dictionary pages; printing that looks like indexes; maps, charts and graphs; etc. Most tests need several sizes and styles of type and, of course, students below the third grade probably should not be tested with even the highest quality typewritten output.

This list of problems is not exhaustive. Nor is it fair to produce such a list without stressing that many of this issues cannot be handled elegantly in manual item banks, either. Indeed, the preceding paragraphs are not designed to question whether computers can make a contribution to educational item banking. They can—and already are in a number of cases. The computer-aided item bank is a virtual certainty that should be vigorously addressed. Computerized systems for categorizing and retrieving objectives, constructing and revising tests, retrieving item use data, and other specialized test development functions are functioning well and are proving to be well worth the effort. In contrast, the vision of a general purpose computerized item bank is frequently overly simplistic or unjustifiable based on the benefits it will produce compared to its cost. There is simply no evidence that a reasonably priced computer system can do all the item banking tasks we would ask of it.

In short, the interest in small computers has made potential users more receptive to item banking, but as during the competency testing movement, the field is in no position to capitalize on that interest. The advent of the small computer does not overwhelmingly alter the balance sheet for item banking.

The Need for Additional Research

An earlier paragraph alluded to the failure of item banking to capture the interest of educational measurement professionals in the manner of criterion-referenced testing or latent trait analysis. While this low profile has permitted item banking to remain a viable issue for two decades while many other innovations have been written off as fads, it has caused a serious problem. The amount of item banking research done to date has been far too small to form the basis for future development efforts. Most item banking efforts are undertaken because someone wants to do the work—in spite of the lack of information as to how it should be done. Perhaps many of these people would find item banking less appealing if it were clear how to proceed. Item banking cannot make a significant contribution to educational measurement until appropriate procedures are developed and validated. These procedures will not be developed until item banking becomes a topic of interest to a wider spectrum of investigators.

With the notable exception of Demaline and Brzezinski's National Institute of Education-sponsored project to investigate the relative merit of tests developed from item banks and item specifications, little evidence exists that item banks are a cost-effective approach to test development. This study should be replicated by others before large scale item bank development is automatically assumed to be a reasonable strategy. And while several state and local education agencies are proceeding with item bank development projects, these are not research activities; we will only learn of the success or failure of the particular approach they undertake. Currently the best hope for item banking research rests with a two-year test utilization study being sponsored by the National Institute of Education and conducted by the Northwest Regional Educational Laboratory. It is our understanding that the initial plans for this project included a heavy emphasis on item bank research; those interested in item banking should follow the progress of this project carefully.

The Item Bank Balance Sheet

Let us now update our balance sheet of educational item banking strengths and weaknesses. As advantages of test item banking, we have the following:

- o Costs of test development may be reduced.
- o Used items are more valuable than new ones, since defective items will be discarded.

As disadvantages (or perhaps more accurately—drawbacks) of item banking, we have the following:

- o Test items can be ineffective or worse when inappropriately used.
- o There is a stigma against using items developed for other audiences.
- o Establishing the collection and quality control procedures is difficult.
- o A sound initial collection of items must be available.
- o Knowledgeable people must be available to maintain the item bank.
- o Establishing the worth of items and ensuring their value is difficult.
- o Obtaining a selection of items adequate for all prospective users is difficult.
- o There are no established techniques for publicizing the item bank
- o Few measurement specialists want their work made substantially easier or less time consuming.
- o Many item banking efforts are carried out by people whose decisions about the merit of the project are not completely objective.
- o Item banking did not perform well during the opportunity provided by the competency testing movement.
- o Although it will definitely make item banking more viable, the small computer is unlikely to lead to a breakthrough in item banking technology.
- o Insufficient research is available to describe how item banking should be done or even to support the contention that it should be done.

The list of disadvantages is sizable, and numerically dwarfs the list of advantages. But the major advantage of test item banking--the promise of substantial cost savings—is more than adequate to justify item banking in the face of the disadvantages. Gypsum wallboard offers only one major advantage over plaster and lath construction—cost savings. But the cost savings were such that gypsum wallboard is the accepted material. Prospective item bankers should not be dismayed by the overwhelming number of points against item banking. If the cost savings accrued

through test item banking approach the theoretical savings, item banking will be a very justifiable activity.

Unfortunately, we have only the first elements of the research necessary to show that the cost savings we expect will result. Until more information is gathered, our analysis suggests that those contemplating item bank development should proceed with considerable caution. Optimism expands to fill the space available for its exercise; thus, the optimistic nature of many item bank advocates may not be warranted. Our balance sheet suggests that until cost savings can be demonstrated, the disadvantages of item banking are likely to outweigh the advantages and will, except for research-oriented projects, limit the number of rational applications.

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A BALANCE SHEET FOR EDUCATIONAL ITEM BANKING

MICHAEL D. HISCOX, Director
Interwest Applied Research, Portland, Oregon

Educational item banking presents observers with a considerable paradox. The development of test items from scratch is viewed as wasteful, a luxury in times of declining resources. On the other hand, item banking has failed to become a mature technology despite large amounts of money and the efforts of talented professionals. This discrepancy will be the focus of the presentation.

A balance sheet will be developed to present the advantages and disadvantages of item banking. Cost estimates for developing item bank tests will be compared to costs for conventional test development in order to develop guidelines for the cost-effective application of item banks. Particular attention will be paid to the role innovative technologies such as microcomputers and videodiscs might play in item banking. The overall objective of the presentation is to provide those attending with a balanced report on the strengths and weaknesses of educational test item banking.

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